NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION SYSTEM, TAILWATER RECOVERY

(No.)

CODE 447

DEFINITION

A planned irrigation system in which all facilities utilized for the collection, storage, and transportation of irrigation tailwater for reuse have been installed.

PURPOSE

This practice may be applied as part of a conservation management system to support one or more of the following:

- Conserve irrigation water supplies
- Improve offsite water quality

CONDITIONS WHERE PRACTICE APPLIES

Tailwater recovery systems are suitable for use on lands and facilities that are served by a properly designed and installed irrigation system where recoverable irrigation runoff flows can be anticipated under current or expected management practices.

This standard applies to the planning and functional design of irrigation tailwater recovery systems including (but not limited to) pickup ditches, sumps, pits, and pipelines. It does not apply to detailed design criteria or construction specifications for individual structures or components of the recovery system.

All land included in the irrigation system shall be suitable for irrigation as outlined in the National Engineering Handbook (NEH) Part 652, Irrigation Guide. An irrigation development plan will be made for the area served by the practice.

CRITERIA

General Criteria Applicable To All Purposes

Laws, rules, and regulations. This practice shall conform to all federal, state, and local laws, rules, and regulations. Laws, rules, and regulations of particular concern include those involving water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.

Collection facilities. Facilities for the collection of irrigation tailwater can be an integral part of irrigation systems covered by Conservation Practice Standards 443, Irrigation System, Surface and Subsurface, and 442, Irrigation System, Sprinkler. These facilities may include (but are not limited to) ditches, culverts, pipelines, water control and/or grade stabilization structures or other erosion control measures as needed.

Storage facilities. Facilities are needed to store the collected water until it is redistributed in the irrigation system. Runoff volume and rate, as well as the required level of water control (at the point where the tailwater is returned to the irrigation system), should be considered in determining the size of the storage facility.

The storage requirements shall meet the criteria listed in this standard and the criteria listed in NEH Part 652, Irrigation Guide, KS652.0710(b). The storage is provided by an embankment pond or pit as follows.

Embankment ponds. Embankment fills made to impound irrigation tailwater will meet the design requirements listed in Conservation Practice Standard 378, Pond.

Pits. Design water surface shall be at the flowline elevation of the inlet structure or 1 foot below the lowest irrigable land elevation adjacent to the pit (whichever is lower). Retrievable tailwater depth shall be a minimum of 5 feet and a maximum of 10 feet. Excavated depth (below design water surface elevation) shall be designed water depth plus 1 foot. The resulting total depth of the pit will be from a minimum of 7 feet to a maximum of 12 feet.

Slopes and top width. Excavation and embankment slopes shall not be steeper than 3:1. Slopes will usually not be flatter than 4:1, except one or both ends may be flattened to 6:1 for ease of construction and cleanout.

Minimum top width of banks, berms, and dikes shall be 8 feet.

Sediment storage. Excavated volume of the tailwater pit may be increased by 25 percent if deemed necessary to allow for normal sedimentation occurring from irrigation tailwater and storm runoff. This will be in addition to sediment basins outlined below.

Sediment basins. A sediment basin should be provided for each tailwater pit. This basin should be located immediately ahead of where the tailwater enters the pit through the mechanical inlet. These basins should be built as flat as possible while maintaining drainage and of such dimensions that they could be readily cleaned out as needed. Sediment basins shall be designed in accordance with Conservation Practice Standard 350, Sediment Basin. In some cases, it may be impractical to design a sediment basin that will contain the expected sediment accumulation during the life of the structure. In these situations, a smaller sediment basin may be designed that will require periodic cleanout.

The purpose of these basins is to prolong the useful life of the tailwater pit by trapping some of the normal amounts of sediment produced by irrigation and storm runoff. They are not, under any circumstances, to be used in protecting the pit from a poorly designed irrigation system or faulty irrigation water management practices.

Mechanical inlet structures. Inlet structures shall be provided to convey the tailwater and/or storm runoff into the pit without erosion damage to the entrance channel or sides of the pit. These structures may consist of chutes, drop structures, or pipes (minimum size of 10 inches in diameter) using corrugated metal, welded steel, plastic, concrete, or other approved material.

Structural design of pipes shall be in accordance with Conservation Practice Standard 620, Underground Outlets, including the material requirements and fill requirements. The inlet structures must have the capacity to satisfy the operating needs of the system. Use standard plans when available. Refer to the Kansas Supplement to Chapter 6 of NEH Part 650, Engineering Field Handbook.

On mechanical inlets consisting of a pipe, a concrete slab around the inlet is desirable. This slab provides erosion protection around the inlet, protects the inlet from damage caused by farm equipment, and provides a cutoff wall to detour seepage along the pipe. If a concrete slab is not used, then appropriate anti-seep collars must be placed on the pipe, according to criteria in Conservation Practice Standard 378, Pond.

If butyl rubber or plastic sheeting is used for a cutoff wall, it should be placed below the sloped surface near the inlet at a depth of not less than 12 inches and backfilled with compacted soil to prevent displacement and ultraviolet light degradation.

If farm equipment will cross over a mechanical pipe inlet, then certain minimum fills will be required over the pipe. These fills, along with the maximum allowable fill over any pipe, are shown in Conservation Practice Standard 620, Underground Outlet.

Emergency spillway or storm bypass. Pits shall be surrounded by berms and dikes to prevent surface water from entering the pits at points other than the mechanical inlet structure. A storm bypass or emergency spillway shall be provided which will pass the runoff from a 25-year, 24-hour frequency Antecedent Moisture Condition (A.M.C.) II storm. Tops of banks and dikes shall be at least 1 foot above the maximum water surface in the pit or the spillway (whichever is higher) when passing this storm.

Ditches. All collecting and conveyance ditches used to collect and deliver tailwater to the pit or pond shall be designed and constructed in accordance with the Conservation Practice Standards 607, Surface Drainage, Field Ditch, and 608, Surface Drainage, Main or Lateral.

Conveyance facilities. All tailwater recovery systems require facilities to convey water from the storage facility to a point of entry back into the irrigation system. These facilities may consist of a pumping plant and pipeline to return the water to the upper end of the field or a gravity outlet having a ditch or pipeline to convey the water to a lower elevation in the irrigation system. Other components or combinations of components may be necessary as determined on a site-specific basis.

The capacity of conveyance facilities shall be determined by an analysis of the expected runoff rate, the planned irrigation pit or regulating reservoir storage capacity, and the anticipated irrigation application. If the return flow is used as an independent irrigation supply rather than as a supplement to the primary irrigation water supply, the rate and volume of flow must be adequate for the methods of water application employed.

Refer to NEH Part 652, Irrigation Guide, KS652.0710(b) for the pumpback flow rate.

Pipelines. Pipelines used to transport water from the pit or pond to the area being irrigated may be buried or laid on the surface. Pipelines shall be designed according to Conservation Practice Standard 430, Irrigation Pipeline

Pumping plant. The minimum capacity of the return pumping plant shall be large enough to meet the pumping needs of the selected irrigation method.

Pumping plant design shall be in accordance with Conservation Practice Standard 533, Pumping Plant, and the criteria set forth in Chapter 8 of National Engineering Handbook, Section 15, Irrigation.

Vegetation and fencing. The exposed surfaces of the embankment, banks, berms, and dikes shall be seeded. Seedbed preparation, seeding, fertilizing, and mulching shall comply with Conservation Practice Standard 342, Critical Area Planting.

Fencing shall be installed as required for the protection of vegetation and for safety considerations. Fencing shall comply with Conservation Practice Standard 382, Fencing.

Screening, aesthetic, and wildlife plantings. Tree or shrub plantings are desirable for wildlife and visual resource enhancement of the area. They shall be designed (when desired) according to Conservation Practice Standards 380, Farmstead and Feedlot Windbreak; 612, Tree Planting; and 645, Wildlife Upland Habitat Management.

Additional Criteria Applicable to Improving Water Quality

Storage facilities. Where additional storage is required to provide adequate retention time for the breakdown of chemicals in the runoff waters, storage facilities shall be sized accordingly. Allowable retention times shall be site specific to the particular chemical used.

Seepage from a storage facility shall be controlled to the extent possible when the storage facility is expected to receive chemical-laden waters. Control may be in the form of natural soil liners, soil additives, commercial liners, or other approved methods.

Where additional storage is required to provide for sediment deposition, storage facilities shall be sized accordingly. Allowable retention times shall be site specific to the particular soil types.

Pond sealing or lining. Necessary sealing measures should be taken if excessive seepage from tailwater recovery pits will result in agricultural chemicals increasing in the ground water. Refer to Conservation Practice Standard 521, Pond Sealing or Lining, for instructions on sealing.

CONSIDERATIONS

Irrigation systems should be designed to limit tailwater volumes to that needed for effective operation. This reduces the need or minimizes the size and capacity of collection, storage, and transportation facilities. Changes in irrigation water management activities will be necessary to accommodate return flows.

Nutrient and pest management measures should be planned to limit chemical-laden tailwater as much as practical. Chemical-laden water can create a potential hazard to wildlife, especially waterfowl that are drawn to ponded water.

Protection of system components from storm events and excessive sedimentation should be considered.

Downstream flows or aquifer recharge volumes dependent on runoff will be reduced. Existing wetland hydrology could be impacted by this practice.

PLANS AND SPECIFICATIONS

Plans and specifications for irrigation tailwater recovery systems shall be prepared for specific field sites in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An operation and maintenance plan specific to the facilities installed shall be prepared for use by the landowner or operator responsible for operation and maintenance. The plan should provide specific instructions for operating and maintaining facilities to ensure they function properly. The plan shall include provisions to address the following (as a minimum):

- Periodic cleaning and re-grading of collection facilities to maintain proper flow lines and functionality
- Periodic checks and removal of debris (as necessary) from trash racks and structures to assure proper operation
- Periodic removal of sediment from traps and/or storage facilities to maintain design capacity and efficiency
- Inspection or testing of all pipeline and pumping plant components and appurtenances (as applicable)
- Routine maintenance of all mechanical components in accordance with the manufacturer's recommendations